Presentation at Wind Energy Denmark 2019

Presentation at Wind Energy Denmark 2019 Global wind market outlook: Offshore and emerging markets offset the slowdown in Mackenzie conventional markets

Shashi Barla | 1 October 2019







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We provide commercial insight and access to our experts leveraging our integrated proprietary metals, energy and renewables research platform

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- Over 500 sector-dedicated analysts and consultants globally, including 75 specifically to power and renewables
- Located close to clients and industry contacts



We focus on the critical intersections of **technologies**, **policies** and **actors** reshaping the energy landscape



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Power and Fuel Markets



Wind Power



Solar Power

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We guide companies leading the electricity transformation into the new energy economy

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Supply Chain	>	Supplier technology strategies, financial health, production capacity, and policy and materials risks
Technology, Systems & Operations	>	Trends in system costs, design, installation, performance and asset management
Market Dynamics	>	Technology-specific competitive landscape and mid-term growth outlooks
Integrated Power Outlooks	>	Power system modeling of long-term, all-technology outlooks on supply, demand and price within regional power system



About the Analyst



Shashi Barla Principal Analyst

Shashi Barla, Principal Analyst-Global wind supply chain and technology

Wood Mackenzie Power and Renewables

Shashi has over 10 years of experience in the global wind industry worked within the industry and as external consultant. Shashi leads Wood Mackenzie's Global Wind Turbine Technology and Supply chain practice. He is responsible for global wind turbine technology trends, supply chain trends, turbine OEM market share developments product positioning strategies, global wind operations and maintenance trends and strategies. Shashi renders his knowledge and expertise to Wood Mackenzie's research and consulting clients. He joined Wood Mackenzie in 2017 and is based in Aarhus, Denmark

Prior to Wood Mackenzie, Shashi was a global key account manager at LM Wind Power, Denmark, and has worked in various roles, primarily in the global market intelligence and strategy function at LM Wind Power. Before LM Wind Power, Shashi was an analyst at GlobalData plc in their wind market intelligence, research and consulting division



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1. Global energy transition outlook to 2040

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Power sector capacity investments will shift to wind, solar and storage

3 TW of wind and solar capacity will be added by 2040: six times larger than investments in gas-fired generation

Global power capacity: net change by generation type, 2020 to 2040



Key takeaways

- From 2010-20, markets installed ~1 TW of wind and solar capacity:
 65% of total power capacity additions over that time.
- Declining LCOEs and broader power market policy will underpin ~3 TW of wind and solar capacity additions from 2020-40.
- Storage costs continue to fall, supporting ~600 GW of stationary storage capacity.
- Gas expands by ~500 GW over 2020-40, a critical source of lower carbon, flexible generation. China adds nearly 150 GW of capacity in this period.
- Nuclear expands in all regions except in Europe and North America, where ~85 GW needs decommissioning. China and India add ~30 GW of new nuclear in Asia Pacific.
- Coal declines within the OECD and falls to zero in some Western European markets. About 60 GW net additions in Asia Pacific.

Source: Wood Mackenzie; stationary storage forecast does not include pumped hydro.



How much capex is deployed to 2040? Over US\$1 trillion a year for both new power generation capacity and fossil supply

Total capex across main energy segments



Risks depend on policy direction and ambition

Upside

- 3 TW solar and wind added by 2040. More additions or a slower cost decline will increase capex
- Oil faces investment inertia but operating capacity and reserve depletion continues
- Expect +20% capex upside to put CCS in place
- IEA sees +50% more investments in power plants in a 2-degree world

Downside

- Weaker economic growth
- Energy efficiency innovation
- Advance materials and technology solve longduration storage issues

Note: Power capex based on our proprietary Integrated LCOE Power Modelling using fuel economics, plant technologies, evolution of policies and market design for grid stability. We expect capex (US\$/KW) to fall and efficiency improvements to continue. Some markets currently face overcapacity issues, and our modelling assumes capital allocation will be economics-driven system-wide after 2025. ** Power plant refurbishment and upgrades on existing capacity; excludes capex related to T&D in new capacity

Source: Wood Mackenzie

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Wind and solar will expand dramatically across key markets – but hydrocarbons still play a critical role

Power is the only commodity that is not 'global' – as such, each market is driven by national policies and incentives, and is also heavily influenced by the domestic supply mix **Power output TWh (global and key markets)**



Global

While RES expands rapidly, our modelling expects that other supply sources are crucial for meeting power demand

RES = 24% by 2040



Europe

Nuclear

Growth compensates for falling nuclear output and helps push coal from the generation mix; gas flat long term

RES > 40% by 2040

Hydro

Wind

Solar



Other solid fuels

China

Acts with growing nuclear and gas output to reduce coal's share of the generation mix to below ~40% in 2035

RES > 20% by 2040

US

Other renewables

Renewables meet incremental growth in power demand

Gas continues to push coal from the US generation mix

RES > 40% by 2040

RES = renewables forecast (solar, wind) does not include hydro

2. Global onshore and offshore wind outlook 2018-2028e



Global upgrades in Q3 over 10 years overwhelm a 3.2GW near-term downgrade in India

Global grid-connected forecast: 2018 to 2028e



Note: Arrows are shown in the table if the delta between quarters is greater than or equal to a 1% increase or decrease in the country's capacity. *See appendix.

The PTC rush in the US nearly counterbalances the combined 4.5GW downgrade in India and Germany

Sub- region*	New Capacity	AAGR	QoQ Δ		
	2019e to 2028e				
North America	93,459MW	2.3%	1		
Latin America	40,905MW	4.5%	—		
Northern Europe	61,896MW	7.5%	1		
Southern Europe	41,851MW	14.8%	1		
Eastern Europe*	21,515MW	71.0%	1		
Western Europe	76,912MW	5.4%	ŧ		
Middle East & Africa	45,042MW	29.7%	-		
China	252,331MW	1.9%	_		
APeC	104,940MW	14.5%	ŧ		
Global	738,852MW	5.5%	_		

15 of the top 20 countries will more than double their installed base by 2028

Poland's auction-driven revival headlines QoQ changes in the ranking; overall, a 2GW upgrade for the top 20 markets QoQ, with seven country upgrades tempered by five receiving downgrades this quarter

Top 20 markets by region: 2018-2028e



Top 20 markets: New capacity 2019e-2028e

Note: (x) refers to QoQ difference in ranking. Source: Wood Mackenzie woodmac.com

Mid-term 504MW US upgrade as New York doubles offshore wind tender capacity

1GW of offshore wind capacity in France is pushed beyond the outlook period, into 2029 and 2030, as a result of a change in the buildout timelines



Offshore top 20 markets: New capacity '19e-'28e

Growing confidence in Poland and Russia catapult Eastern Europe up the ranking

A 31% upgrade in Russia QoQ as developers push forward amidst realization of localisation strategies; Poland will auction a 2.5GW onshore auction in Q4, stimulating market development and resulting in a 15% upgrade Top 20 emerging markets: New capacity 2019e-2028e Emerging markets by region: 2018-2028e



Note: Ranking based on largest growth between 2019 and 2028 and with less than 1GW of capacity installed through YE/2018. AAGR arrow applies to the top 20 emerging markets only. Source: Wood Mackenzie

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1.1GW repowering upgrade QoQ due primarily to Italy (+690MW) and the US (+250MW)

The increasing availability of economic lifetime extension solutions offer owners an alternative to traditional repowering, potentially depressing the volume of repowered assets as LTE solutions become mainstream



Top 20 repowering markets by capacity '19e-'28e Top 20 repowering markets by region: '18-'28e

Note: Gray shading indicates capacity fully repowered from 2019 to 2023. Color shading indicates capacity fully repowered from 2024 to 2028. Does not include refurbishments. Source: Wood Mackenzie

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Demand across regions is dispersing as mature markets hit speed bumps

Stagnating growth is expected in today's key markets, while emerging regions are picking up speed globally.





Contact us

Shashi Barla (Denmark)

T +45 8736 2296

M +45 2165 6665

E shashi.barla@woodmac.com

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 Europe
 +44 131 243 4400

 Americas
 +1 713 470 1600

 Asia Pacific
 +65 6518 0800

 Email
 contactus@woodmac.com

 Website
 www.woodmac.com

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